CLAIMS

1. A head support mechanism comprising a head and a slider for carrying the head, the head being caused to track by main driving means, wherein:

the head support mechanism further comprises driving sub-means comprising a thin film and causing the head to have a micro-movement; and

the driving sub-means causes the head to have a micro-movement by utilizing flexural deformation of the thin film.

2. A head support mechanism according to claim 1, wherein the thin film has a film thickness equal to or less than 10 μm.

3. A head support mechanism according to claim 1, wherein:

the thin film is formed on a base material and has a film thickness equal to or less than 10 μm; and

the thin film is formed on the base material by using a film growth process.

4. A head support mechanism according to claim 3, wherein the film growth process comprises a direct film growth process.

5. A head support mechanism according to claim 3, wherein the film growth process comprises a transcription process.

6. A head support mechanism according to claim 1, wherein:

the head support mechanism includes a plurality of plate spring portions disposed in a radial arrangement from a rotation center;

the driving sub-means is formed on the plurality of plate spring portions; and

the driving sub-means rotates the slider around the rotation center, causing the head to have a micro-movement along a tracking direction.

7. An information recording/reproducing apparatus comprising: a head support mechanism having a head and a slider for carrying the head; main driving means for causing the head to track via the head support mechanism, so that information on a disk is recorded/reproduced by means of the head, wherein:

the head support mechanism comprises driving sub-means comprising a thin film and causing the head to have a micro-movement; and

the driving sub-means causes the head to have a micro-movement by utilizing flexural deformation of the thin film.

8. An information recording/reproducing apparatus according to claim 7, wherein the thin film is formed so that the thickness direction substantially coincides with a tracking direction of the head.

9. An information recording/reproducing apparatus according to claim 7, wherein the thin film has a film thickness equal to or less than 10 μm.

10. An information recording/reproducing apparatus according to claim 7, wherein a main portion of a member comprised by the driving sub-means is disposed in a space within the thickness, from the disk surface, of the slider along a height direction.

11. An information recording/reproducing apparatus according to claim 7, wherein the driving sub-means is in the vicinity of a position along a height direction from the disk surface of a center of gravity of the slider.

12. An information recording/reproducing apparatus according to claim 7, wherein the head support mechanism includes a plurality of thin plate spring portions formed substantially perpendicular to the disk surface.

13. An information recording/reproducing apparatus according to claim 12, wherein:

the driving sub-means further comprises a base material to function as an actuating plate; and

the base material comprises a spring material.

14. An information recording/reproducing apparatus according to claim 7, wherein the driving sub-means is of a piezoelectric type, electrostatic type, electromagnetic type, magnetostrictive type, or shape memory alloy type.

15. An information recording/reproducing apparatus according to claim 7, wherein the driving sub-means comprises a piezoelectric material, electrostrictive material, or magnetostrictive material.

16. An information recording/reproducing apparatus according to claim 7, wherein the head support mechanism comprises:

a first member coupled to the slider; and

a second member coupled to the main driving means,

wherein the driving sub-means is formed on the first

member.

17. An information recording/reproducing apparatus according to claim 16, wherein the first member comprises a flexure for causing the slider to follow the disk surface.

18. An information recording/reproducing apparatus according to claim 7, wherein:

the first member further comprises a thin metal plate;

the thin metal plate includes a bent portion which is formed by bending; and

the driving sub-means is formed on the bent portion.

19. An information recording/reproducing apparatus according to claim 18, wherein:

the bent portion is bent in a direction which is substantially perpendicular to the disk surface; and

the bent portion includes a grooved portion for enhancing the processing precision of the bending.

20. An information recording/reproducing apparatus according to claim 18, wherein:

the bent portion is formed so that its bent height dimension is smaller than a dimension of the slider along a first direction which is a rotation axis direction of the disk; and

a dimension of the driving sub-means along the first direction is smaller than the dimension of the slider along the first direction.

21. An information recording/reproducing apparatus according to claim 7, wherein:

the head support mechanism further comprises a driving

sub-means formation member on which the driving sub-means is formed; and

recording/reproducing signal wiring coupled to the head is formed on the driving sub-means formation member.

22. An information recording/reproducing apparatus according to claim 7, wherein:

the head support mechanism includes a plurality of parallel spring portions formed substantially perpendicular to the disk surface;

the driving sub-means is formed on the plurality of parallel spring portions; and

the driving sub-means translates the head along a tracking direction.

23. An information recording/reproducing apparatus according to claim 7, wherein:

the head support mechanism includes a plurality of plate spring portions disposed in a radial arrangement from a rotation center;

the driving sub-means is formed on the plurality of plate spring portions; and

the driving sub-means rotates the slider around the rotation center, and causes the head to have a micro-movement along a tracking direction.

24. An information recording/reproducing apparatus according to claim 23, wherein the plurality of plate spring portions comprise a plate spring portion having a longitudinal direction along the tracking direction.

25. An information recording/reproducing apparatus according to claim 23, wherein the plurality of plate spring

portions comprise a plate spring portion having a longitudinal direction along a direction substantially perpendicular to the tracking direction.

26. An information recording/reproducing apparatus according to claim 7, wherein the head support mechanism comprises a pair of driving sub-means.

27. An information recording/reproducing apparatus according to claim 7, wherein the driving sub-means is located so as to be substantially parallel to a direction in which the slider is disposed.

28. An information recording/reproducing apparatus according to claim 7, wherein the driving sub-means are disposed in such a manner that extensions of directions in which the driving sub-means are disposed constitute predetermined angles with respect to an extension of a direction in which the slider is disposed, so as to intersect at a leading end of the head support mechanism.

29. An information recording/reproducing apparatus according to claim 23, wherein the driving sub-means constitutes an angle equal to or greater than 15° with a plane perpendicular to disk surface.

30. An information recording/reproducing apparatus according to claim 7, wherein:

the head support mechanism further comprises a first member coupled to the slider;

the driving sub-means is formed on the first member; and the driving sub-means are disposed in such a manner that a center of gravity of the first member is located in the

vicinity of an intersection between extensions of directions in which the driving sub-means are disposed.

31. An information recording/reproducing apparatus according to claim 7, wherein the head support mechanism comprises two or more pairs of driving sub-means.

32. An information recording/reproducing apparatus according to claim 7, wherein the driving sub-means is formed by using a semiconductor process.

33. An information recording/reproducing apparatus according to claim 7, wherein the driving sub-means comprises restraint alleviation means for restraining at least a portion of the thin film.

34. An information recording/reproducing apparatus according to claim 33, wherein the restraint alleviation means comprises means for weakening the rigidity of the driving sub-means.

35. An information recording/reproducing apparatus according to claim 33, wherein the restraint alleviation means comprises a spring structure.

36. An information recording/reproducing apparatus according to claim 33, wherein the restraint alleviation means comprises a low rigidity material.

37. An information recording/reproducing apparatus according to claim 33, wherein the restraint alleviation means comprises wiring for applying to the thin film a driving voltage for driving the thin film.

38. An information recording/reproducing apparatus according to claim 7, wherein the information recording/reproducing apparatus further comprises control means for controlling the main driving means and the driving sub-means.

39. An information recording/reproducing apparatus according to claim 7, wherein:

the thin film is formed on a base material; and

the thin film is formed on the base material by using a film growth process.

40. An information recording/reproducing apparatus according to claim 39, wherein the film growth process comprises a direct film growth process.

41. An information recording/reproducing apparatus according to claim 40, wherein the thin film comprises a metal film, an underlying layer, a thin film piezoelectric, and a metal electrode film, which are sequentially layered on the base material.

42. An information recording/reproducing apparatus according to claim 40, wherein the thin film comprises an insulation film, a metal film, an underlying layer, a thin film piezoelectric, and a metal electrode film, which are sequentially layered on the base material.

43. An information recording/reproducing apparatus according to claim 40, wherein the thin film comprises a metal film, an underlying layer, a thin film piezoelectric, and a metal electrode film, which are sequentially layered

on the base material in a vacuum chamber.

44. An information recording/reproducing apparatus according to claim 40, wherein the thin film comprises an insulation film, a metal film, an underlying layer, a thin film piezoelectric, and a metal electrode film, which are sequentially layered on the base material in a vacuum chamber.

45. An information recording/reproducing apparatus according to claim 40, wherein:

the thin film comprises a metal film; and

the metal film is formed by either a vacuum process or a process in a liquid.

46. An information recording/reproducing apparatus according to claim 39, wherein the film growth process comprises a transcription process.

47. An information recording/reproducing apparatus according to claim 46, wherein the thin film is formed of a multilayer film having a metal film, a thin film piezoelectric, an underlying layer, and a metal electrode film, adhered on the base material.

48. An information recording/reproducing apparatus according to claim 39, wherein the thin film and the slider are disposed along a tracking direction of the head.

49. An information recording/reproducing apparatus according to claim 39, wherein the thin film is formed on the base material in such a manner that the thickness direction substantially coincides with a tracking direction

of the head.

50. An information recording/reproducing apparatus according to claim 39, wherein the thin film is formed on the base material in such a manner that the thickness direction is substantially perpendicular to the disk surface.

51. An information recording/reproducing apparatus according to claim 39, wherein:

the base material is elastic; and

the base material has a thickness such that a flexural rigidity required for allowing the slider to follow the waving disk surface and a displacement required for tracking are both obtained.

52. An information recording/reproducing apparatus according to claim 51, wherein the thickness of the base material is equal to or greater than 0.5μm and equal to or less than 50μm.

53. An information recording/reproducing apparatus according to claim 39, wherein the base material is formed of stainless steel.

54. An information recording/reproducing apparatus according to claim 39, wherein the base material is formed of silicon.

55. An information recording/reproducing apparatus according to claim 39, wherein:

the thin film comprise a thin film piezoelectric; and

the thin film piezoelectric is formed by an rf

sputtering method, an ion beam sputtering method, a sol-gel method, a CVD method, or a laser ablation method.

56. An information recording/reproducing apparatus according to claim 55, wherein the thin film piezoelectric comprises a PZT film.

57. An information recording/reproducing apparatus according to claim 55, wherein the thin film piezoelectric comprises a ZnO film.

58. An information recording/reproducing apparatus according to claim 55, wherein the thin film piezoelectric comprises a PVDF film.

59. An information recording/reproducing apparatus according to claim 39, wherein the thin film is formed on both sides of the base material so as to interpose the base material therebetween.

60. An information recording/reproducing apparatus according to claim 39, wherein:

the thin film comprises a thin film piezoelectric; and

the thin film piezoelectric is entirely covered by an insulation film.

61. An information recording/reproducing apparatus according to claim 60, wherein the insulation film comprises a material whose main component is polyimide, an SAM film, an LB film, or a nitride.

62. An information recording/reproducing apparatus according to claim 7, wherein:

the thin film comprises a pair of thin films;

the pair of thin films are disposed substantially parallel to the disk surface; and

voltages having reverse phases are applied to the thin film provided on one side of the head and the thin film provided on the other side of the head so that the thin films warp in opposite directions.

63. An information recording/reproducing apparatus according to claim 7, wherein:

the thin film comprises a pair of thin films;

the pair of thin films are disposed substantially parallel to the disk surface; and

voltages having the same phase are applied to the thin film provided on one side of the head and the thin film provided on the other side of the head so that the thin films warp in the same direction.

64. An information recording/reproducing apparatus according to claim 39, wherein the thin film comprises an underlying layer.

65. An information recording/reproducing apparatus according to claim 64, wherein the underlying layer comprises a PT layer, a PLT layer, a PBTi03 layer, an SrTi03 layer, or a BaTi03 layer.

66. An information recording/reproducing apparatus according to claim 65, wherein the PLT layer contains substantially no Zr.

67. An information recording/reproducing apparatus according to claim 64, wherein:

the thin film comprises a metal film which is layered adjacent to the underlying layer; and

the metal film comprises either a platinum film or a titanium film.

68. An information recording/reproducing apparatus according to claim 39, wherein the base material includes wiring for applying a voltage to the thin film.

69. An information recording/reproducing apparatus according to claim 68, wherein the wiring is formed after the thin film is formed on the base material.

70. A method for manufacturing a head support mechanism comprising a head and a slider for carrying the head, the head being caused to track by main driving means, wherein: the head support mechanism further comprises driving sub-means comprising a thin film and causing the head to have a micro-movement; the driving sub-means causes the head to have a micro-movement by utilizing flexural deformation of the thin film; the thin film is formed on a base material; and the thin film is formed on the base material by using a film growth process, comprising:

a first step of forming the thin film on the base material by using a film growth process; and

a second step of attaching the slider carrying the head onto the base material.

71. A method for manufacturing a head support mechanism according to claim 70, wherein the first step comprises a third step of forming the thin film on the base material by using a direct film growth process.

72. A method for manufacturing a head support mechanism according to claim 71, wherein the third step comprises a fourth step of sequentially layering a metal film, an underlying layer, a thin film piezoelectric, and a metal electrode film on the base material.

73. A method for manufacturing a head support mechanism according to claim 71, wherein the third step comprises a fourth step of sequentially layering an insulation film, a metal film, an underlying layer, a thin film piezoelectric, and a metal electrode film on the base material.

74. A method for manufacturing a head support mechanism according to claim 71, wherein:

the thin film comprises a metal film; and

the third step comprises a fourth step of forming the metal film by either a vacuum process or a process in a liquid.

75. A method for manufacturing a head support mechanism according to claim 70, wherein the first step comprises a third step of forming the thin film on the base material by using a transcription process.

76. A method for manufacturing a head support mechanism according to claim 75, wherein the third step comprises:

a fourth step of sequentially layering a metal film, an underlying layer, a thin film piezoelectric, and a metal electrode film on a transcription substrate;

a fifth step of adhering the base material to a layering surface of the transcription substrate; and

a sixth step of removing the transcription substrate from the metal film.

77. A method for manufacturing a head support mechanism according to claim 76, wherein the transcription substrate is formed of MgO, sapphire, strontium titanate, or silicon.

78. A method for manufacturing a head support mechanism according to claim 70, wherein the base material is formed of stainless steel.

79. A method for manufacturing a head support mechanism according to claim 70, wherein the base material is formed of silicon.

80. A method for manufacturing a head support mechanism according to claim 70, wherein:

the thin film comprises a thin film piezoelectric;

the first step comprises a third step of forming the thin film piezoelectric by an rf sputtering method, an ion beam sputtering method, a sol-gel method, a CVD method, or a laser ablation method.

81. A method for manufacturing a head support mechanism according to claim 70, wherein the first step comprises a third step of forming the thin film on both sides of the base material so as to interpose the base material therebetween.

82. A method for manufacturing a head support mechanism according to claim 70, wherein:

the thin film comprises a thin film piezoelectric; and

the first step comprises a third step of forming the thin film piezoelectric.

83. A method for manufacturing a head support mechanism according to claim 82, wherein the thin film piezoelectric comprises a PZT film.

84. A method for manufacturing a head support mechanism according to claim 82, wherein the thin film piezoelectric comprises a ZnO film.

85. A method for manufacturing a head support mechanism according to claim 82, wherein the thin film piezoelectric comprises a PVDF film.

86. A method for manufacturing a head support mechanism according to claim 70, wherein:

the thin film comprises a thin film piezoelectric; and

the first step comprises a third step of entirely covering the thin film piezoelectric with an insulation film.

87. A method for manufacturing a head support mechanism according to claim 86, wherein the insulation film comprises a material whose main component is of polyimide, an SAM film, an LB film, or nitride.

88. A method for manufacturing a head support mechanism according to claim 70, wherein the first step comprises a third step of forming the thin film on both sides of a position at which the head is attached with respect to tracking direction of the head.

89. A method for manufacturing a head support mechanism according to claim 70, wherein:

the thin film comprises an underlying layer; and

the first step comprises a third step of forming the underlying layer.

90. A method for manufacturing a head support mechanism according to claim 89, wherein the underlying layer comprises a PT layer, a PLT layer, a PBTi03 layer, an SrTi03 layer, or a BaTi03 layer.

91. A method for manufacturing a head support mechanism according to claim 90, wherein the PLT layer contains substantially no Zr.

92. A method for manufacturing a head support mechanism according to claim 89, wherein the first step comprises a fourth step of forming a metal film which is layered adjacent to the underlying layer; and

the metal film comprises either a platinum film or a titanium film.

93. A method for manufacturing a head support mechanism according to claim 70, wherein the method for manufacturing a head support mechanism further comprises, after the thin film is formed on the base material, a third step of forming wiring on the base material for applying a voltage to the thin film.